

# News and Plan of MAPS Project

Ming Liu

Los Alamo National Lab

9/16/2016

# For Today

- Progress on MoU
  - LANL R&D needs
  - sPHENIX production
- Near term plan
  - Prepare for next C&S review (~Nov./Dec.)
  - Update resource plan and C&S
  - Establish collaboration for early R&D work
  - Start regular meetings (bi-weekly?)

# Summary of Meeting with ALICE/ITS Manager Dr. Luciano Musa, 09/12/2016

- A Skype Meeting ~1.5hr, Luciano and Ming
  - Very productive, discussed many technical details of MoU
  - Concluded with a to-do list and possible timeline
- Updated current status
  - LANL LDRD scope and plan
  - sPHENIX MAPS proposal and recommendations from recent tracking review
  - ALICE/ITS MAPS project progress status
- MoU discussions
  - LANL LDRD MoU
  - sPHENIX production MoU
- CERN and ALICE managements are fully aware of our intention to use MAPS for sPHENIX inner tracking
  - ALICE spokespersons + ITS project management
  - CERN Exp. Dept. Director of Research
  - Work out a MoU between CERN and BNL for sPHENIX project

# LANL R&D MoU

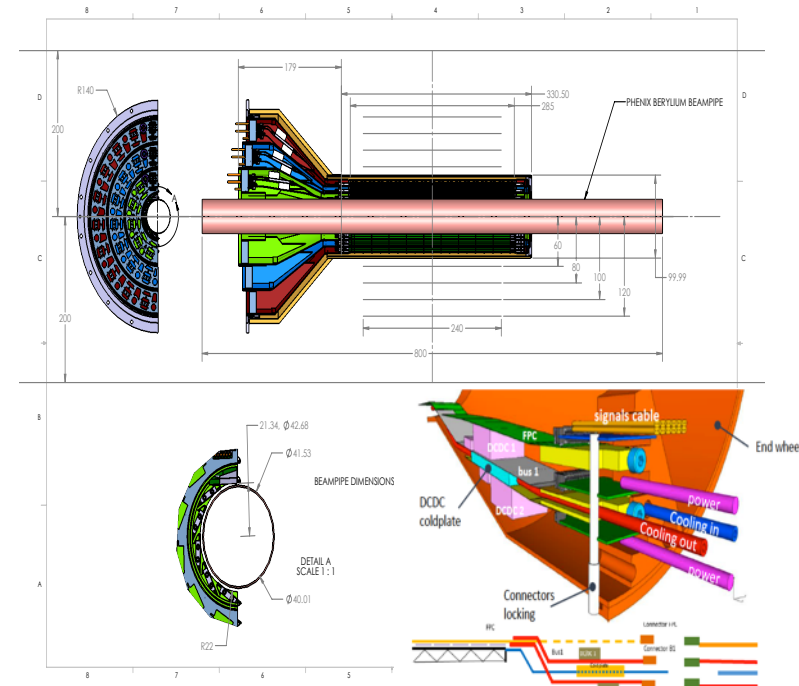
- Join ALICE/ITS project as associate members
  - Work on ALICE/ITS project at CERN/ALICE and build up experience on MAPS technologies
    - Assembly, operate and test MAPS/staves at CERN
    - At a level of ~1FTE for 6 months, 1/2017 – 7/2017
  - R&D for sPHENIX MAPS prototype detector
    - Obtain ALICE/ITS prototype staves and readout system and test bench for R&D
    - CERN facilities and expertise
    - Readout and mechanics
    - Software
- Access/obtain needed technical design files for MAPS R&D
  - Intellectual property agreement on MAPS, TBD, likely not an issue (Luciano will follow up)
  - Allow us to reproduce readout electronics boards (RDO, CRU etc) in US if needed
  - Modify mechanical structure as needed
- Action items:
  - Ming/LANL will work with Luciano to write “Express of Interest” to join ALICE/ITS project as associate members (Luciano will send design drawings and sample letter etc.), ~2 weeks
  - Luciano will present the request to the ALICE collaboration at next Alice Collaboration Meeting, early November 2016
  - Ming+LANL folks will visit CERN Labs and attend ALICE Week/Collaboration Meeting during the week of 11/7-11, 2016, discuss collaboration plan etc.
  - Luciano/ALICE will provide technical documents and design files for LANL R&D
  - Luciano/ALICE will help to procure prototype detector+test bench etc. for LANL R&D

# CERN-BNL MoU for sPHENIX Production

- Defined the minimal scope of the project in the MoU
  - A 3-layer MAPS detector identical to ITS/IB
    - 48 staves + 40% spares = 68
  - MAPS chips
    - 68 fully tested staves,  $68 \times 9 = 612$  chips
    - 20% fully tested spare MAPS chips,  $612 \times 20\% = 122$  chips
    - Total 734 MAPS chips
  - Flexible PC boards (FPC) with connectors and cables
    - One per stave, 68 of them
    - Cables and connectors customized to meet CERN safety rules
      - Luciano/CERN will send documents to confirm they also meet BNL safety standards
  - Fully assembled and tested Staves
    - Preparation and cleaning of MAPS, FPCs and frames etc.
    - Alignment and gluing
    - Wire bonding
    - Assembly work mostly done by CERN techs
    - Final testing mostly by sPHENIX students/postdocs/techs
  - Mount staves on the ITS/IB space frame, ship fully tested space frame to BNL
    - Space frames to mount staves
    - Cold plates
    - Electrical connectors etc.
    - Mechanical tubes/connectors
    - Metrology done at CERN
  - Setup a construction DB for sPHENIX production
    - Traveler documents
- All produced at CERN by ALICE ITS production lines
  - CERN technicians and facilities
  - With help from sPHENIX students/postdoc + some Techs

# CERN-BNL MoU for sPHENIX Production (cont.)

- sPHENIX Beam pipe and ITS/IB End Wheels
  - Default plan is to use the same End Wheels for sPHENIX MAPS tracker
    - CERN will produce them for sPHENIX
  - If needed, CERN engineer can also adjust the current MAPS/IB design to increase the inner radius a bit to fit the sPHENIX beam pipe, while keeping the full azimuthal coverage.
    - But this also requires redesign of the End Wheels.
- Service End Wheels
  - sPHENIX likely needs to modify/redesign it, not in the MoU CERN procurement
- 5m long SAMTEC cables
  - Modified by SAMTEC to meet ALICE/CERN safety requirements; CERN provides document to help sPHENIX's procurement
    - 5m length is close to the limit for 1.2Gb/s signal; ALPIDE-4 can drive longer distance at lower speed ~600Mb/s.
    - 600Mb/s already sufficient for ALICE (by x2)



# CERN-BNL MoU for sPHENIX Production (cont.)

- Readout Electronics
  - RDO boards
    - One per stave,  $48 + 20\%$  spare = 58 total
    - CERN produce and test them all
      - some special parts produced at CERN only
  - CRU
    - NOT in the MoU, could be added later if needed.
    - One for every 2 staves,  $48/2 + 20\% = 29$
    - Reproduce with design files in US possible
- Action items
  - Luciano/ALICE will produce preliminary cost estimate and production schedule
  - Early R&D on readout integration, the need of CRU or not.
  - Early sPHENIX R&D to determine the maximum length of SAMTec cable needed for sPEHINX
  - Early sPHENIX mechanical integration design to determine the scope of mechanical system work
  - Try to have a draft by Oct. 15, 2016
- Scope of MoU
  - Scientific collaboration
  - Preliminary cost and schedule estimate

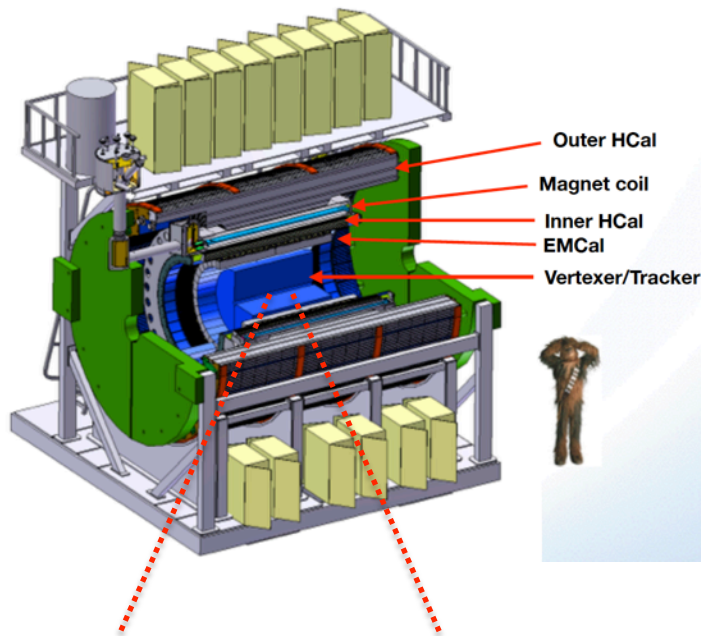
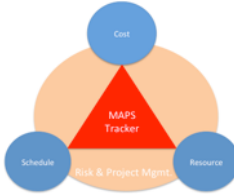
# Near Term Plan

- A draft MoU by mid of October
- LANL R&D starts Oct. 3, 2016
  - Setup test bench etc.
- Prepare for next sPHENIX C&S review
  - Implement recent review recommendations
  - Funding approach, CD-1/3a, MoU etc
- Update resource plan and C&S
  - Identify resources for major tasks
    - MIT, LBNL?, UT-Austin and other institutions
  - Project FTE profile, students and postdocs contributions etc
- Establish collaboration for early R&D work
  - Visit MIT Bate lab in late October
    - mechanical system
  - Visit CERN ALICE/ITS Labs in Nov.,
    - Join ITS project, train new people
    - MAPS readout and test
  - Visit LBNL, UT-Austin and other institutions?
    - Joint R&D for LANL LDRD and sPHENIX
  - Meet people, visit facilities, match resources to tasks
- Hold regular meetings (bi-weekly?)
  - discuss progress, issues and needs etc.



# Reference Slides

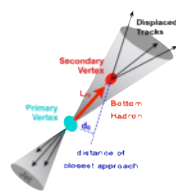
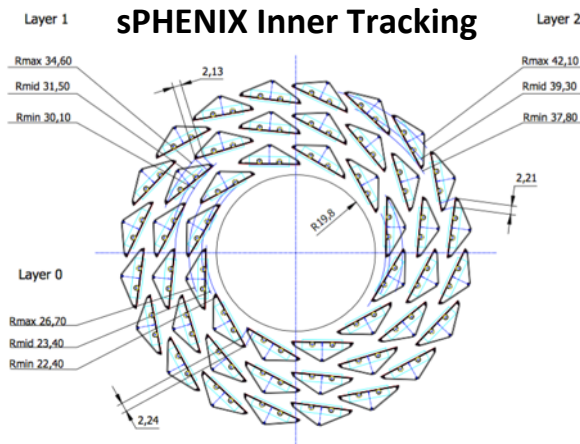
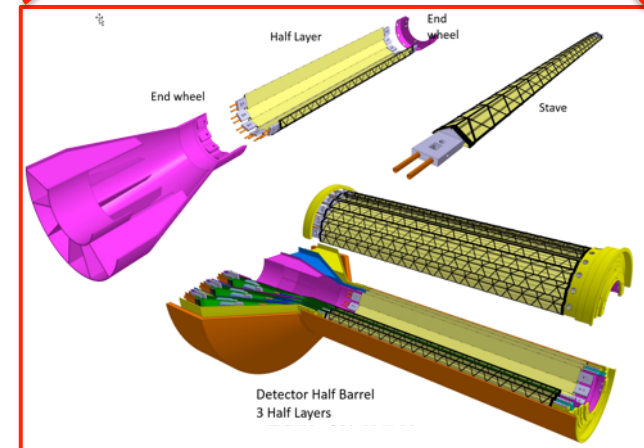
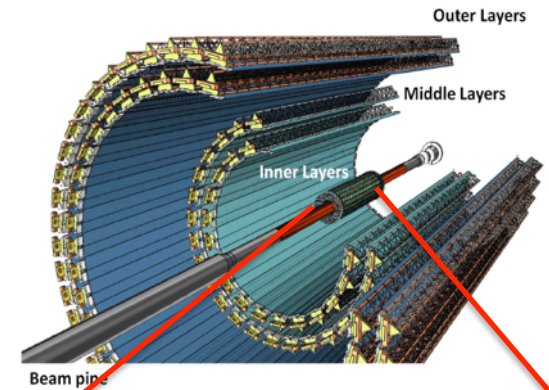
# sPHENIX MAPS Inner Tracker



*Key issues:*

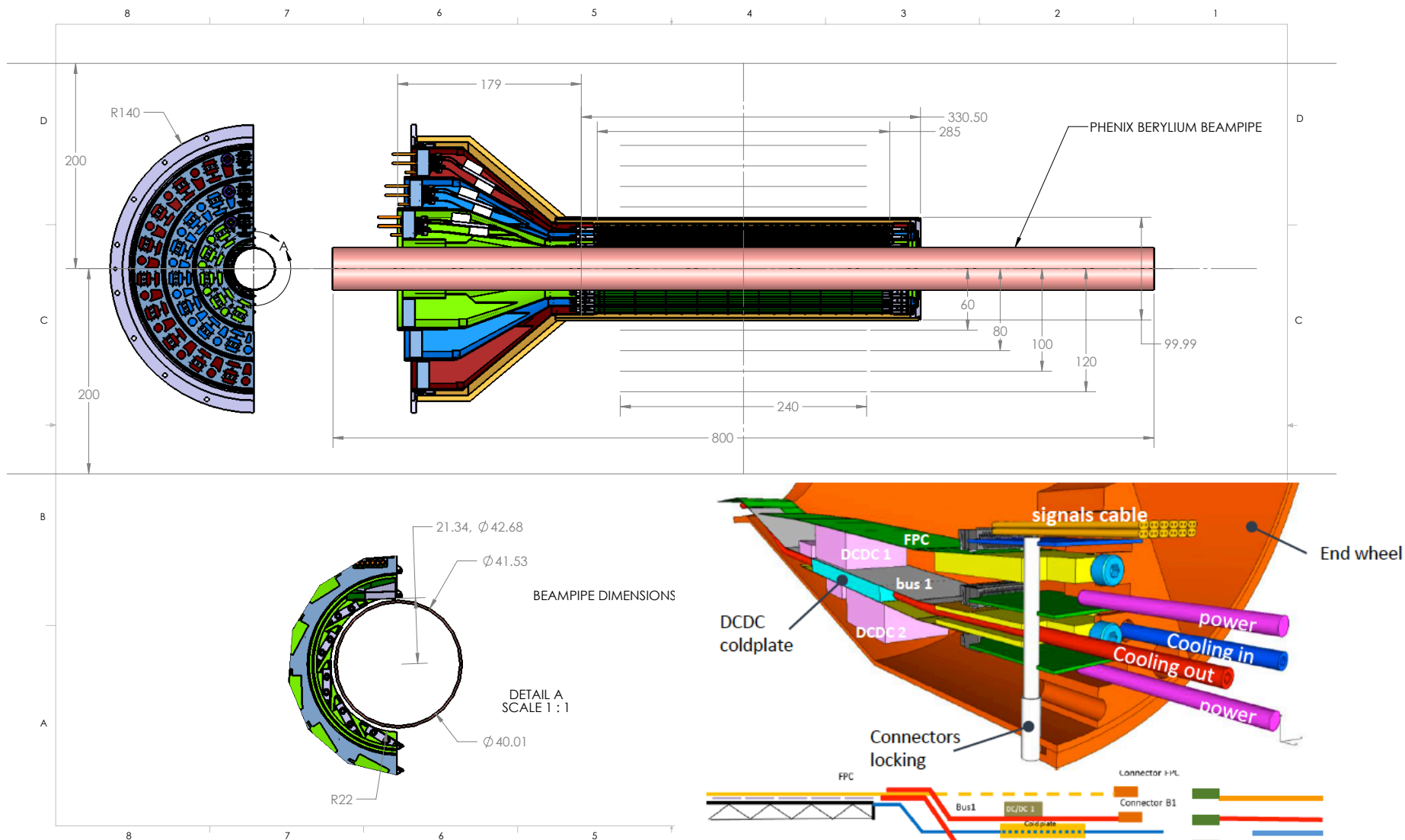
- Readout
- Mechanics

ALICE ITS;  
Inner Tracker System



Copy of ITS  
Inner Tracker

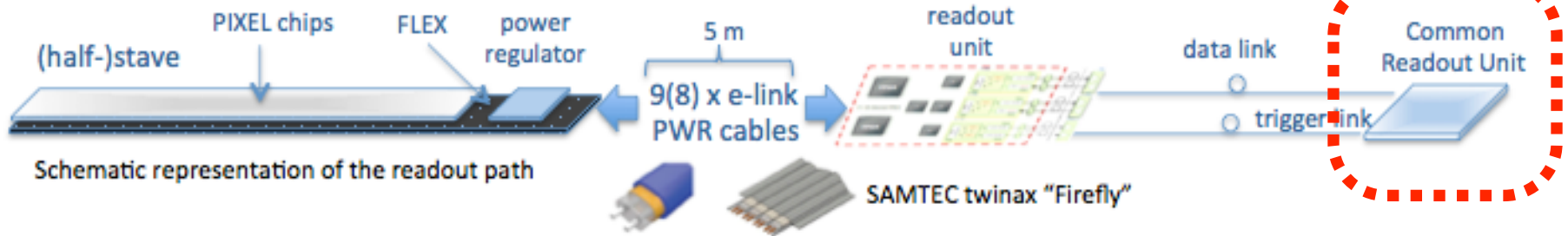
# sPHENIX MAPS Inner Tracker



# MAPS Electronics

## ALICE readout path

Plan A:  
reprogram



## Plan B: sPHENIX readout path (held as contingency)

